Nov. 21, 1961 E. R. PRICE 3,009,448

SERVOMOTOR WHOSE POWER DRIVEN ELEMENT REMAINS STATIONARY DURING MANUAL ACTUATION

Original Filed July 16, 1957 2 Sheets-Sheet 1

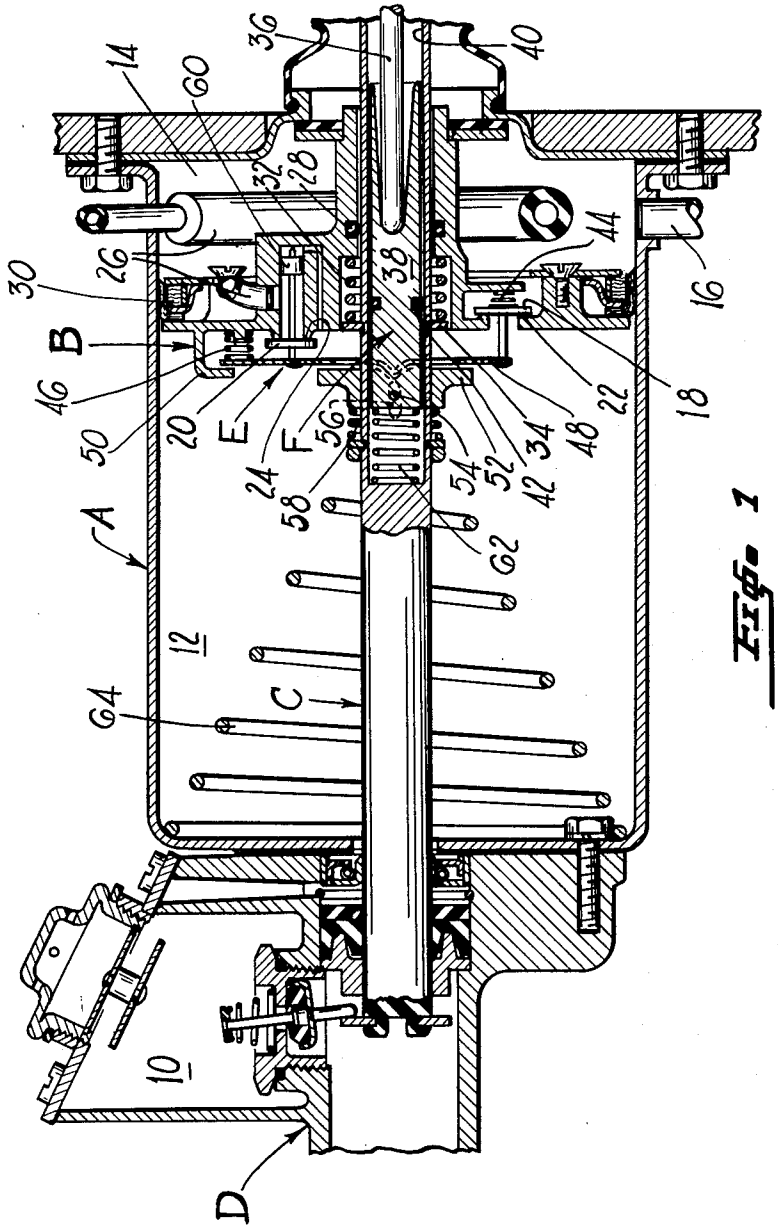


Fig. 1

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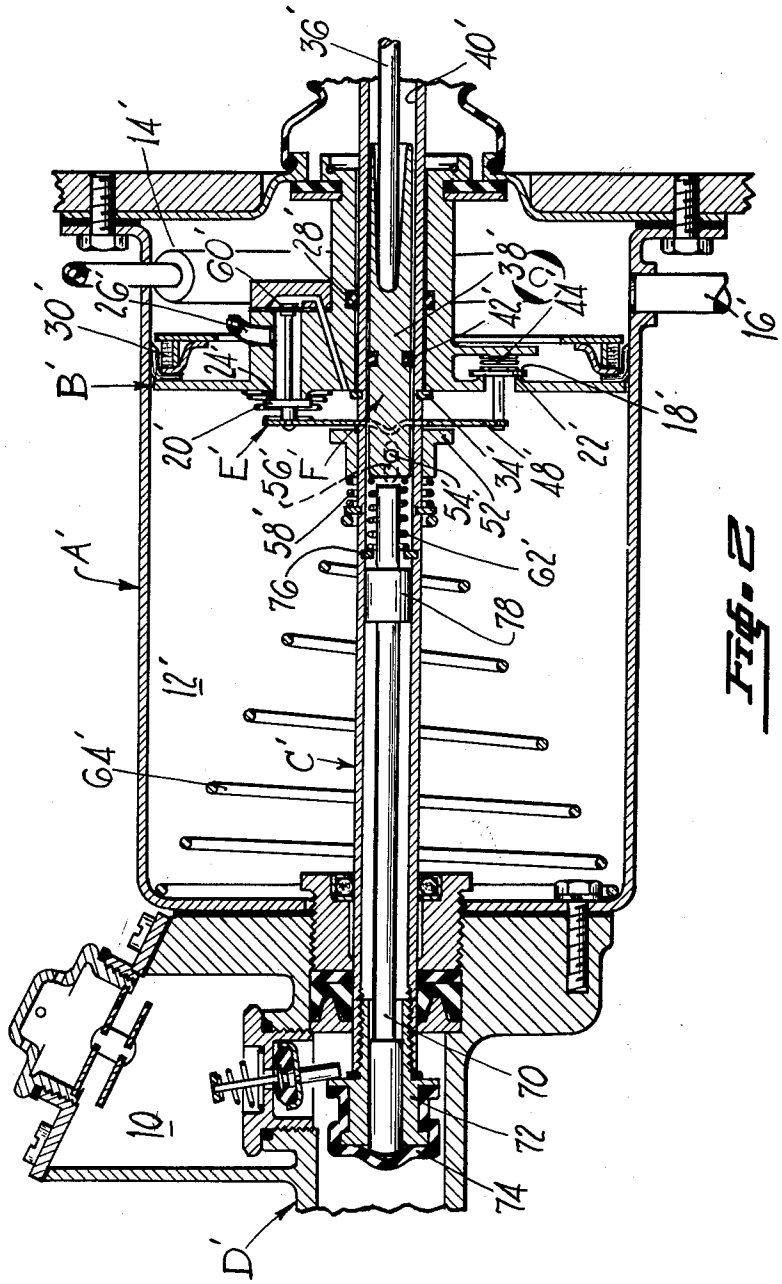


Fig. 2

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United States Patent Office

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SERVOMOTOR WHOSE POWER DRIVEN ELEMENT REMAINS STATIONARY DURING MANUAL ACTUATION

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Continuation of abandoned application Ser. No. 672,285, July 16, 1957. This application Nov. 27, 1959, Ser. No. 855,741

12 Claims. (Cl. 121—41)

The present invention relates to a type of servomotor in which its driven member can be moved manually through its power actuated element without carrying the power actuated element with it when power is not available to actuate the element; and to new and improved reaction means for servomotors generally. This application is a continuation of my copending application Serial No. 672,285 filed July 16, 1957.

An object of the present invention is the provision of a new and improved servomotor of the above mentioned type having a cylindrically-shaped driven member which extends through a power actuated element for forcing the driven element in a given direction, and which cylindrically-shaped member can be forced through the power actuated member during power failure without dragging any part of the power actuated element along with it.

Another object of the invention is the provision of a new and improved fluid pressure servomotor in which the control valving for the power actuated movable wall is mounted on the movable wall in a manner to be actuated from the rear surface of the movable wall; said servomotor further comprising a driven element adapted to be forced rearwardly by the movable wall but which may be moved rearwardly manually without carrying the movable wall along with it; and a valve control member which extends through the movable wall to its rear side, said control member being adapted to slide through the movable wall and leave the control valve structure intact when the driven element is forced rearwardly manually.

Another object of the invention is the provision of a new and improved fluid pressure servomotor of the above described type in which the control member is mounted in the driven member and is provided with suitable abutment means which extends outwardly of the driven member on the rear side of the control valve structure to actuate the same.

A further object of the invention is the provision of a new and improved fluid pressure servomotor of the immediately above described type in which reaction means is carried by the driven member in a manner to abut the inner end of the control member.

Another object of the invention is the provision of a new and improved servomotor in which: its control means is carried on its power actuated means; the control member for the control means is reciprocable with respect to the motor driven element; reaction is provided by spring means operatively positioned between the control member and the driven element; and follow-up spring means is operatively positioned between the power actuated means and the driven element to permit a change in relative position of the power actuated means relative to the driven element which corresponds to changes in position of the control member relative to the driven element in such manner as to permit said control means to assume its "set-point" or non-actuating condition when

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the force exerted by the power actuated means through the follow-up spring means becomes generally proportional to the reaction exerted by the first mentioned spring means.

The invention resides in certain constructions and combinations and arrangements of parts, and further objects and advantages will be apparent to those skilled in the art to which the invention relates from the following description of the preferred embodiment described with reference to the accompanying drawings forming a part of this specification, and in which:

FIGURE 1 is a cross-sectional view of one embodiment of a fluid pressure servomotor which incorporates principles of the present invention; and

FIGURE 2 is a cross-sectional view of another fluid pressure servomotor embodying principles of the present invention.

The fluid pressure servomotor shown in FIGURE 1 of the drawings is specifically adapted for the actuation of the hydraulic braking system in an automotive vehicle. The unit generally comprises a power cylinder A having a movable wall or piston B therein adapted to force a fluid displacement member C into a hydraulic cylinder D which is suitably affixed to the rear end wall of the power cylinder A. The hydraulic cylinder D is provided with a reservoir 10 for holding a supply of compensating fluid for replenishing that fluid which is lost due to leakage in the vehicle braking system; and the discharge of the hydraulic cylinder D is communicated by a connection not shown to the hydraulic braking system of the vehicle. For a more complete understanding of the construction and operation of the hydraulic cylinder D, reference may be had to Earl R. Price Patent 2,685,170.

As previously indicated, an object of the present invention is the provision of a servomotor in which its driven element can be moved manually through its power actuated movement (which in the present instance is a pressure actuated movable wall) without carrying the power actuated element along with the driven element. While fluid pressure actuated servomotors could be built with the control means mounted on the driven element, the preferred embodiment shown in FIGURE 1 of the drawings mounts the control elements (which in the present instance is the control valve structure E) on the power actuated element or movable wall B in a manner to be actuated from its rear surface. The servomotor, shown, is further provided with a control member F which projects through the power actuated element B to actuate the control means E from its rear surface in such manner that the driven element C and the control member F may be forced manually through the power actuated element B without carrying either the power actuated element B or the control means E along with it. The advantages of such a structure are believed to be readily apparent to those skilled in the art, and will not be elaborated upon.

The fluid pressure servomotor shown in FIGURE 1 is an atmospheric submerged unit in which atmospheric pressure is communicated to opposite sides of the power piston B during the normal or released condition of the vehicle brakes; and in which vacuum is communicated to the rear power chamber 12 to actuate the vehicle brakes. Atmospheric pressure is continually admitted to the front power chamber 14 through the atmospheric connection 16; and the pressure within the rear power chamber 12 is controlled by means of the control valve structure E

which is mounted on the power piston B, and which comprises an atmospheric poppet valve 18 and a vacuum poppet valve 20. The atmospheric poppet 18 cooperates with a forwardly facing valve seat 22 to regulate the flow of atmospheric pressure from the front power chamber 14 to the rear power chamber 12, and the vacuum poppet 20 cooperates with a rearwardly facing valve seat 24 to regulate the flow of vacuum from the flexible conduit 26 with the rear power chamber 12. The flexible conduit 26 is adapted to extend externally of the servomotor where it can be connected with the manifold of the vehicle engine in a manner well known in the art.

The driven element or fluid displacement member C of the embodiment shown in FIGURE 1 is an axially positioned cylindrical member which projects through the power piston B by an amount which is substantially equal to or which exceeds the stroke of the power piston D; so that the fluid displacement member C can be forced through the power piston B manually without becoming separated from the power piston. Suitable vacuum seals 28 and 30 are provided between the fluid displacement member C and the power piston, and between the power piston B and the cylinder A, respectively, to seal off the rear power chamber 12 from the front power chamber 14; and a suitable follow-up spring 32 whose function will later be described is positioned between the power piston B and an abutment 34 on the fluid displacement member C to transfer rearwardly directed force from the power piston B to the fluid displacement member C.

The control member F is adapted to be actuated by means of the brake pedal lever of the automotive vehicle through the push rod 36, and is so arranged with respect to the valve structure E that its initial inward movement with respect to the power piston B communicates vacuum to the rear power chamber 12 to urge the power piston B rearwardly when power is available; and is further arranged such that continued inward movement of the control member F relative to the power piston B will force the fluid displacement member C rearwardly manually. While the control member or members F may extend through the power piston B in any suitable manner, the preferred form of the invention will consist of a single member mounted in the fluid displacement member C in such manner that its line of force will be co-axial with that of the fluid displacement member C. The control member F shown in the drawing is formed by means of a cylindrical member 38 positioned in a cylindrical bore 40 in the outer end of the fluid displacement member C, and which is provided with a suitable vacuum seal 42 which seals with respect to the side walls of the cylindrical bore 40. In the preferred valving arrangement, the atmospheric poppet 18 is biased rearwardly to its closed position by means of a coil spring 44, and the vacuum poppet 20 is biased rearwardly to its open position by means of a coil spring 46 which is positioned against a walking beam arrangement 48 which bridges the fluid displacement member C and is connected to each of the poppets. A suitable stop 50 is provided on the power piston B to limit rearward movement of the walking beam 48. The walking beam 48 is abutted on its rear side by an annular abutment member 52 which surrounds the fluid displacement member C and is fixed to the control member 38 by means of a pin 54. The pin 54 extends through suitable slotted openings 56 in the opposite side walls of the cylindrical bore 40 to provide sufficient relative movement between the control member 38 and the fluid displacement member C to actuate the control valve structure E. The annular abutment member 52, and hence the control member 38 is biased forwardly by a return coil spring 58 having sufficient force to overcome the coil springs 44 and 46 to bias the vacuum poppet 20 to its closed position and the atmospheric poppet 18 to its open position; thereby establishing a normal atmospheric suspended, or de-energized condition of the servomotor. In order that the spring forces involved might be kept to a minimum, the pressure forces across the vacuum poppet are balanced by a balancing piston 60 affixed to the vacuum poppet 20. The front side of the piston 60 is subjected to the same vacuum supplied to the vacuum poppet 20 and the back side of the piston 60 is communicated with the rear power chamber 12. "Reaction" is provided in the embodiment shown in FIGURE 1 by a reaction coil spring 62 positioned between the rear end of the control member 38 and the bottom of the cylindrical bore 40, and the function of which will be hereinafter described.

Power actuation of the embodiment shown in FIGURE 1 is initiated by inward movement of the push rod 36. In the normal or de-energized condition of the servomotor previously described, the vacuum poppet 20 will be closed and the atmospheric poppet 18 will be biased open by means of the force exerted by the return coil spring 58. Inward movement of the control member 38 forces the annular abutment member 52 inwardly to permit the walking beam 48 to move inwardly, thereby closing the atmospheric poppet 18 and opening the vacuum poppet 20. Pressure within the rear power chamber 12 will thereupon be reduced causing the power piston B to move inwardly thereby transmitting its force through the follow-up spring 32 to the abutment 34 on the fluid displacement member C to force the fluid displacement member C rearwardly. In the preferred embodiment, a slight amount of clearance will be provided between the reaction spring 62 and the control member 38 to permit the initial actuation of the servomotor unit to take place without delivering a reactive force against the foot of the operator. Initial inward movement of the control member 38 relative to the fluid displacement member C permits the walking beam 48 to move rearwardly relative to the power piston B to open the valve structure E and communicate vacuum to the rear power chamber 12. After sufficient pressure differential has been created across the power piston B to overcome the force exerted against the power piston B by means of the follow-up spring 32, the power piston B will move rearwardly relative to the fluid displacement member C by an amount permitting the vacuum poppet 20 to close and thereby assume its lapped condition, which may be thought of as a "set point" or "control point." Continued inward movement of the control member 38 relative to the fluid displacement member C will increasingly compress the reaction spring 62 to deliver more and more force against the foot of the operator. Whenever forward motion of the control member 38 relative to the fluid displacement member C is stopped, rearward motion of the walking beam 48 will of course be stopped and the pressure within the power chamber 12 will continue to be reduced until such time as the differential pressure across the power piston B will be sufficient to compress the follow-up spring 32 to an extent permitting the vacuum valve seat 24 carried on the power piston B to walk into engagement with the vacuum poppet 20. It will therefore be seen that the follow-up spring 32 permits the relative position between the power piston B and the control member 38 to "follow-up" the change in relative position between the control member 38 and fluid displacement member C; so that the lapped condition or "set point" of the control structure will be continually adjusted to correspond with the change in position between the control member F and the servomotor driven element C.

When it is desired to reduce the force developed by the fluid pressure servomotor, retraction of the control member 38 relative to the fluid displacement member C will permit the coil spring 58 to close the vacuum poppet 20 and thereafter open the atmospheric poppet 44 to bleed air into the rear power chamber 12. A reduction in the pressure differential across the movable power piston B permits the follow-up spring 32 to bias the power piston B rearwardly relative to the fluid displacement member C

by an amount permitting the coil spring **44** to again open the atmospheric poppet **18**. Complete retraction of the control member **38** relative to the fluid displacement member C will permit the atmospheric poppet **18** to remain open, and the power piston B to move into its retracted position seen in FIGURE 1 under the action of the hydraulic pressure within the hydraulic cylinder D and the return spring **64** for the fluid displacement member C.

During periods of power failure, the fluid displacement member C may be forced rearwardly to pressurize the fluid within the hydraulic cylinder D without dragging with it either the power piston B or the valve structure E mounted thereon. Rearward movement of the control member **38** relative to the fluid displacement member C will of course compress springs **62** and **58**, to permit the walking beam **48** to move into abutment with the stop **50**, and the vacuum poppet **20** to be opened. Inasmuch as no vacuum is available to create a differential pressure across the power piston B, at this time, the power piston B will remain stationary in the power cylinder A by reason of the fact that the vacuum seal **28** is considerably smaller than the vacuum seal **30** and the drag between the power piston B and the fluid displacement C is appreciably less than that between the power piston B and the power cylinder A. Continued inward movement of the control member **38** causes force from the control member to be transmitted to the fluid displacement member C through the reaction spring **62**, and the fluid displacement member C to be driven inwardly into the hydraulic cylinder D. The slotted openings **56** will preferably be so constructed that the pin **54** will abut the inner end of the slots at approximately the time that the reaction spring **62** is fully compressed to prevent damage to the reaction spring. Inward movement of the fluid displacement member C will cause the annular abutment member **52** to walk away from the walking beam **48** permitting the power piston B and the control valve structure E to remain stationary and intact. The fluid displacement return spring **64** of course will be compressed; and when it is desired to release the brakes, retraction of the control member **38** permits the return spring **64** and the hydraulic pressure created within the hydraulic cylinder D to force the fluid displacement member C rearwardly to its retracted position, and the annular abutment member **52** to again move into engagement with the walking beam **48** to again close the vacuum poppet **20** and open the atmospheric poppet **18**.

The embodiment shown in FIGURE 2 is similar to that shown in FIGURE 1, differing principally in the manner in which reaction is delivered to the control member **38'**. Those parts in FIGURE 2 which are similar to those shown in FIGURE 1 will be identified by a like reference numeral characterized further in that a prime mark is affixed thereto. The fluid displacement member C' of the embodiment shown in FIGURE 2 is formed by a generally tubular member whose central opening **40'** extends for the full length of the fluid displacement member and extends into the hydraulic cylinder D'. The control valve structure E' and control member F' correspond generally with that of the preceding embodiment, excepting that the balance piston **60** of the preceding embodiment has been replaced by a diaphragm structure **60'** which obviates the necessity of a stop structure **50** for the walking beam **48'**. "Reaction" in the present embodiment is provided by means of a plunger member **70** positioned in the inner end of the fluid displacement member C' to transfer force due to the hydraulic pressure within the hydraulic cylinder D' against the control member **38'**. The end of the fluid displacement member C' positioned in the hydraulic cylinder D' is provided with an annular headed member **72** which is screwed into the end of the fluid displacement member, and which is adapted to receive a diaphragm structure **74** positioned over the annular headed member **72** to effectively seal off the central opening **40'** of the fluid displacement member C' from the hydraulic cylinder D'. Plunger member **70** abuts the inner face of the diaphragm structure **74** at one end and extends into close proximity with the control member **38'**—leaving sufficient space between the end of the plunger member **70** and the control member **38'** to permit the initial valve actuating movement from being opposed by the plunger member **70**. The spring **62'**, in the present embodiment, is positioned within the central chamber **40'** and is biased directly against the control member **38'**. The other end of the spring **62'** is biased against a stop **76** formed by a snap ring positioned within the chamber **40'**, and which stop **76** also limits the forward movement of the plunger member **70** by the engagement of an enlarged centering and guiding section **78** of the plunger member positioned rearwardly of the snap ring **76**.

The operation of the embodiment shown in FIGURE 2 will be identical with that of the previously described embodiment excepting that no follow-up of the piston B' is necessary to correct for a change in position of the "set point" of the valve structure E' relative to the control member **38'**, as was necessary in the embodiment shown in FIGURE 1. This is due to the fact that the reaction means in the present embodiment can assume any position relative to the fluid displacement member C' regardless of the reactive force being transmitted so long as the inner end of the plunger member **70** bears against the diaphragm **74** to transmit its force against the control member **38'**. The piston B' in the present embodiment abuts directly against the abutment **34'** affixed to the fluid displacement member C'; so that the lapped condition of the valve structure E' always occurs at a fixed relative position between the control member **38'** and the power piston B'.

Suffice it to say that power actuation of the embodiment shown in FIGURE 2 is initiated by inward movement of the control member **38'** which causes a closing of the atmospheric poppet **18'**, and a subsequent opening of the vacuum poppet **20'** before the control member **38'** abuts the hydraulic reaction member or plunger **70**. This will initiate a pressure differential across the power piston B' which forces the fluid displacement member C' rearwardly into the hydraulic cylinder D' to pressurize the fluid therein sufficiently to force the plunger member **70** forwardly into engagement with the control member **38'**. Continued rearward movement of the control member **38'** will thereafter be opposed by the plunger member **70**. If the inward force applied by the foot of the operator to the control member **38'** exceeds the opposing force of the plunger member **70**, the vacuum poppet **20'** will be held off of its seat to permit the power piston B' to continue to move rearwardly until such time as the hydraulic pressure created within the hydraulic cylinder D' produces a force upon the plunger member **70** which will balance that being held against the control member **38'** by the foot of the operator. When the reaction of the plunger **70** equals the force being held upon the plunger member **38'**, further inward movement of the plunger **38'** will be prevented, rearward movement of the walking beam **48'** will cease, and the walking beam **48'** will thereafter pivot about the annular abutment member **52'** while the power piston B' continues to move rearwardly just sufficiently to bring the vacuum valve seat into engagement with the vacuum poppet **20'**. Power piston B' will thereafter remain stationary, and the brakes of the vehicle will be held applied at an intensity generally corresponding with the force exerted by the operator upon the control member **38'**.

When it is desired to release the brakes, the operator reduces the force which he holds against the control member **38'**; whereupon, the force delivered against the control member **38'** by the plunger **70** exceeds the force being delivered by the foot of the operator causing the control member **38'** to be moved rearwardly under the reactive force of the plunger **70**. Forward movement of the abut-

ment 52' holds the vacuum poppet 20' against its seat to cause a pivoting action of the walking beam 48' in a direction opening the atmospheric poppet 18'. The vacuum within the rear power chamber 12' is therefore reduced to permit the power piston B' to move forwardly under the action of the hydraulic pressure within the hydraulic cylinder D' and the return spring 64'. At any time that the operator stops his retraction of the brake pedal lever, the control member 38' will become stationary; and the power piston B' will move forwardly, thereafter, a sufficient amount to permit the walking beam 38' to move forwardly relative to the control member 38' by an amount permitting the atmospheric poppet 18' to become lapped with respect to its valve seat. A hydraulic pressure will thereafter be held in the hydraulic cylinder D' which is generally proportional to the now decreased force being held against the control member 38' by the foot of the operator. If the operator should permit the pedal to be completely retracted, the control member 38' will be moved forwardly under the action of the spring 48' to thereafter hold the atmospheric poppet 18' off of its seat to permit the servomotor to become completely de-energized and the power piston B' to assume its fully retracted position.

While the preferred embodiments have been described in considerable detail, I do not wish to be limited to the particular constructions shown and described; and it is my intention to cover hereby all novel adaptations, modifications, and arrangements thereof which come within the practice of those skilled in the art to which the invention relates.

I claim:

1. In a servomotor: a power actuated member, a member adapted to be driven in a first direction by said power actuated member, said driven member being movable in said first direction relative to said power actuated member, control means carried by said power actuated member and constructed and arranged to cause said power actuated member to move in said first direction when elements of said control means are moved in said first direction, a control member movable relative to said driven member and constructed and arranged to move said control elements in said first direction during movement of said control member in said first direction and to provide a nonactuating condition of said control means when said power actuated member and control member are in predetermined relationship to each other, a graduation spring operatively interpositioned between said control member and said driven member for exerting a gradually increasing force or reaction against said control member when said control member is moved in said first direction relative to said driven member, and a followup spring operatively interposed between said power actuated member and said driven member permitting relative movement between said power actuated member and said driven member and for transferring force in said first direction from said power actuated member to said driven member, whereby a gradually increasing reaction is provided against said control member by said graduation spring during movement of said control member relative to said driven member, and said followup spring permits said power actuated member to followup said relative movement to adjust the nonactuating condition of said control means to correspond with the relative positions of said control and driven members.

2. In a fluid pressure servomotor: a power chamber, a fluid pressure actuated movable wall in said power chamber, a member adapted to be driven in a first direction by said movable wall, said driven member being movable in said first direction relative to said movable wall, control valve means carried by said movable wall and constructed and arranged to cause said movable wall to move in said first direction when elements of said control valve means are moved in said first direction, a control member movable relative to said driven member and constructed and arranged to move said control valve elements in said first direction during movement of said control member in said first direction and to provide a lapped condition of said valve means when said movable wall and control member are in predetermined relationship to each other, a graduation spring operatively interpositioned between said control member and said driven member for exerting a gradually increasing force or reaction against said control member when said control member is moved in said first direction relative to said driven member, and a followup spring operatively interposed between said movable wall and said driven member permitting relative movement between said movable wall and said driven member and for transferring force in said first direction from said movable wall to said driven member, whereby a gradually increasing reaction is provided against said control member by said graduation spring during movement of said control member relative to said driven member, and said followup spring permits said movable wall to followup said relative movement to provide lapped conditions of said control valve means to correspond with the relative positions of said control and driven members.

3. In a fluid pressure servomotor: a power chamber having inner and outer ends, a movable wall having a normal retracted position in said power chamber and constructed and arranged to be driven toward said inner end of said power chamber from said normal position by differential pressure across said movable wall, a generally cylindrically shaped driven member extending through said power chamber and said movable wall, said driven member being movable inwardly relative to said movable wall and having a portion projecting outwardly from said movable wall by an amount generally corresponding to the inward travel of said movable wall from its normal retracted position, said outwardly projecting portion being slidable inwardly through said movable wall, control valve means for regulating the differential pressure across said movable wall, a control member for actuating said control valve means, said control member having an initial position relative to said driven member wherein said control valve means is in its lapped position and being movable inwardly therefrom relative to said driven member by a slight amount to actuate said valve means in a manner producing differential pressure across said movable wall in a direction urging said movable wall inwardly, abutment means whereby said control member may force said driven member inwardly after producing said inward valve movement, and abutment means for transferring inwardly directed force from said movable wall to said driven member, whereby inward movement of said control member will cause a power actuated followup movement of said driven member when power is available to actuate said servomotor, and whereby continued inward movement of said control member thereafter will cause the driven member to move through said movable wall without moving said movable wall when power is not available to operate said servomotor.

4. In a fluid pressure servomotor: a power chamber having inner and outer ends, a movable wall having a normal retracted position in said power chamber and constructed and arranged to be driven toward said inner end of said power chamber from said normal position by differential pressure across said movable wall, a generally cylindrically shaped driven member extending through said power chamber and said movable wall, said driven member being movable inwardly relative to said movable wall and having a portion projecting outwardly from said movable wall by an amount generally corresponding to the inward travel of said movable wall from its normal retracted position, said outwardly projecting portion being slidable inwardly through said movable wall, control valve means carried by said movable wall for regulating the differential pressure across said mov-

able wall, said valve means having an element thereof positioned inwardly of said movable wall and said valve means being constructed and arranged to produce a differential pressure across said movable wall which urges said movable wall inwardly when said element is moved inwardly relative to said movable wall, and causing said movable wall to move outwardly when said element is moved outwardly relative to said movable wall, a control member projecting through said movable wall and having an abutment positioned inwardly of said element, said control member being reciprocable inwardly and outwardly relative to said movable wall, spring means operatively arranged to urge said abutment outwardly causing said valve means to induce outward movement of said movable wall, abutment means whereby said control member may force said driven member inwardly after producing said inward valve movement, and abutment means for transferring inwardly directed force from said movable wall to said driven member, whereby inward movement of said control member will cause a power actuated followup movement of said driven member when power is available to actuate said servomotor, and whereby continued inward movement of said control member thereafter will cause the driven member and control member to move through said movable wall without moving said movable wall when power is not available to operate said servomotor.

5. In a fluid pressure servomotor: a power chamber having inner and outer ends, a movable wall having a normal retracted position in said power chamber and constructed and arranged to be driven toward said inner end of said power chamber from said normal position by differential pressure across said movable wall, a generally cylindrically shaped driven member extending through said power chamber and said movable wall, said driven member being movable inwardly relative to said movable wall and having a portion projecting outwardly from said movable wall by an amount generally corresponding to the inward travel of said movable wall from its normal retracted position, said outwardly projecting portion being slidable inwardly through said movable wall and said driven member having a longitudinally extending opening therein which extends inwardly from its outer end to a position which is inwardly of said movable wall at all times, abutment means on said movable wall and said driven member for causing inward movement of said movable wall to force said driven member inwardly, inlet and outlet poppet valve means carried by said movable wall for controlling differential pressure across said movable wall, said poppet valve means being actuatable from the inner side of said movable wall, a control element for said valve means positioned inwardly of said movable wall which element when moved outwardly regulates said pressure differential in a manner causing said movable wall to move outwardly and when moved inwardly regulates said pressure differential in a manner causing said movable wall to move inwardly, a control member in said longitudinally extending opening and having an abutment positioned inwardly of said control element, said control member being reciprocable relative to said driven member by an amount capable of actuating said valve means and having abutment means thereon which picks up and forces said driven member inwardly after having actuated said valve means, said abutment being movable inwardly away from said control element, first means biasing said control element inwardly and causing said valve means to produce pressure differential biasing said movable wall inwardly, and second means biasing said abutment outwardly against said control element, said second means being capable of overpowering said first means, whereby inward movement of said control member when power is not available to actuate said movable wall causes said driven member to slip through said movable wall without carrying the movable wall or the poppet valve means with it.

6. In a fluid pressure servomotor: a power chamber having inner and outer ends, a movable wall having a normal retracted position in said power chamber and constructed and arranged to be driven toward said inner end of said power chamber from said normal position by differential pressure across said movable wall, a generally cylindrically shaped driven member extending through said power chamber and said movable wall, said driven member being movable inwardly relative to said movable wall and having a portion projecting outwardly from said movable wall by an amount generally corresponding to the inward travel of said movable wall from its normal retracted position, said outwardly projecting portion being slidable inwardly through said movable wall and said driven member having a longitudinally extending opening therein which extends inwardly from its outer end to a position which is inwardly of said movable wall at all times, abutment means on said movable wall and said driven member for causing inward movement of said movable wall to force said driven member inwardly, inlet and outlet poppet valve means carried by said movable wall for controlling differential pressure across said movable wall, said poppet valve means being actuatable from the inner side of said movable wall, a control element for said valve means positioned inwardly of said movable wall which element when moved outwardly regulates said pressure differential in a manner causing said movable wall to move outwardly and when moved inwardly regulates said pressure differential in a manner causing said movable wall to move inwardly, a control member in said longitudinally extending opening and having an abutment positioned inwardly of said control element, said control member being reciprocable relative to said driven member by an amount capable of actuating said valve means and having abutment means thereon which picks up and forces said driven member inwardly after having actuated said valve means and said abutment being movable inwardly away from said control element, first means biasing said control element inwardly and causing said valve means to produce pressure differential biasing said movable wall inwardly, second means biasing said abutment outwardly against said control element, said second means being capable of overpowering said first means, a reaction spring positioned between the bottom of said longitudinally extending opening and said control member for providing a reaction against said control member when said control member is moved inwardly with respect to said driven member from a given position, and a followup spring positioned between said abutment means, whereby reaction is provided when power is available to operate said movable wall, and said driven member may slip through said movable wall without carrying the movable wall or poppet valve means with it when power is not available to operate said movable wall.

7. A fluid pressure motor substantially as set forth in claim 6 and wherein: said poppet valve means comprises a pair of poppets positioned on either side of said driven member, said control element bridges said pair of poppets and extends around said driven member, and said abutment means on said control member comprises an annular ring surrounding said driven member, said annular ring being pinned to said control member through slotted openings in said driven member adapted to limit relative movement for actuating said poppets.

8. In a fluid pressure servomotor: a power chamber having inner and outer ends, a fluid pressurizing chamber adjacent the inner end of said power chamber, a movable wall having a normal retracted position in said power chamber and constructed and arranged to be driven toward said inner end of said power chamber from said normal position by differential pressure across said movable wall, a generally tubularly shaped driven member extending through said power chamber and said movable wall

into said fluid pressurizing chamber, said driven member being movable inwardly relative to said movable wall and having a portion projecting outwardly from said movable wall by an amount generally corresponding to the inward travel of said movable wall from its normal retracted position, said outwardly projecting portion being slidable inwardly through said movable wall and said driven member having a longitudinally extending opening therein which extends inwardly from its outer end to a position which is inwardly of said movable wall at all times, abutment means on said movable wall and said driven member for causing inward movement of said movable wall to force said driven member inwardly, inlet and outlet poppet valve means carried by said movable wall for controlling differential pressure across said movable wall, said poppet valve means being actuatable from the inner side of said movable wall, a control element for said valve means positioned inwardly of said movable wall which element when moved outwardly regulates said pressure differential in a manner causing said movable wall to move outwardly and when moved inwardly regulates said pressure differential in a manner causing said movable wall to move inwardly, a control member in said longitudinally extending opening and having an abutment positioned inwardly of said control element, said control member being reciprocable relative to said driven member by an amount capable of actuating said valve means and having abutment means thereon which picks up and forces said driven member inwardly after having actuated said valve means and said abutment being movable inwardly away from said control element, first means biasing said control element inwardly and causing said valve means to produce pressure differential biasing said movable wall inwardly, second means biasing said abutment outwardly against said control element, said second means being capable of overpowering said first means, a hydraulic reaction member in the inner end of said generally tubularly shaped driven member, the inner end of said hydraulic reaction member being subjected to pressure in said fluid pressurizing chamber and the outer end of said reaction member being adapted to abut said control member, whereby reaction is provided when power is available to operate said movable wall, and said driven member may slip through said movable wall without carrying the movable wall or poppet valve means with it when power is not available to operate said movable wall.

9. A fluid pressure motor substantially as set forth in claim 8 and wherein: said poppet valve means comprises a pair of poppets positioned on either side of said driven member, said control element bridges said pair of poppets and extends around said driven member, and said abutment means on said control member comprises an annular ring surrounding said driven member, said annular ring being pinned to said control member through slotted openings in said driven member adapted to limit relative movement for actuating said poppets.

10. In a servomotor: a body member having inner and outer ends and a power actuated member therein adapted to be power actuated inwardly from a normal retracted position, a fluid pressurizing chamber spaced inwardly from said power actuated member, a driven member projecting through said power actuated member and having a generally tubularly shaped portion projecting into said fluid pressurizing chamber to displace fluid therefrom, said driven member being movable inwardly relative to said movable wall and having a portion projecting outwardly through said power actuated member by an amount generally corresponding to normal inward movement of said power actuated member, a control element on the inner end of said power actuated member, said control element when in an inner position causing said power actuated member to move inwardly and when in an outer position causing said power actuated member to move outwardly, first means biasing said control element to its inner position, said driven member having a longitudinally extending opening in its outer portion which extends inwardly of said control element, a control member in said opening movable relative to said driven member and having abutment means thereon for biasing said control element to its outer position, second means biasing said control member outwardly, said second means being stronger than said first means to normally hold said control element in its outer position, abutment means on said power actuated and driven members which permits said power actuated member to force said driven member inwardly and which permits said driven member to be manually moved inwardly relative to said power actuated member, and a hydraulic reaction member in said inner portion of said driven member, the inner end of said hydraulic reaction member being subjected to pressure in said fluid pressurizing chamber and the outer end of said reaction member being adapted to transfer its reaction forces to said control member, whereby reaction is provided when power is available to operate said power actuated member, and said driven member may slip through said power actuated member without carrying said power actuated member when power is not available to actuate the driven member.

11. In a servomotor: a housing, a power actuated member having a normal retracted position in said housing and constructed and arranged to be driven toward the inner end of said housing from said normal position when power actuated, a generally cylindrically shaped driven member having a tubular portion extending through said power actuated member, abutment means between said driven and power actuated members whereby power actuation of said power actuated member drives said driven member inwardly, said driven member being slidable through said power actuated member and said tubular portion projecting outwardly of said housing by an amount generally corresponding to the inward travel of said power actuated member from its normal position, control means for said power actuated member and having a control element positioned on the inner end of said power actuated member, said control element when moved inwardly of a normal position relative to said power actuated member to an actuated position causing said power actuated member to be power actuated, actuating means biasing said control element to its actuated position, a control rod in said tubular portion and having an abutment thereon for moving said control element to its normal position, spring means operatively arranged to urge said abutment outwardly to oppose said actuating means and normally holding said control element in its normal position, and abutment means between said control rod and said driven member whereby inward movement of said control rod drives said driven member through said power actuated member after said control element moves to its actuated position and power is not available to actuate the power actuated member.

12. In a servomotor: a housing having rear and forward ends, a power actuated member having a normal retracted position in said housing and constructed and arranged to be power actuated rearwardly from said normal position, a generally cylindrically shaped driven member extending through said power actuated member, said driven member being movable rearwardly, relative to said power actuated member and having a portion projecting forwardly from said power actuated member by an amount generally corresponding to the rearward movement of said power actuated member, said forwardly extending portion being slidable rearwardly through said power actuated member, control means for said power actuated member, said control means having a control element on the rear end of said power actuated member, said control element when moved rearwardly from a neutral position causing said power actuated

member to move rearwardly and when moved forwardly from said neutral position causing said power actuated member to move forwardly, a control member extending rearwardly through said power actuated member and having an abutment positioned rearwardly of said control element for biasing said control element forwardly, first means biasing said control element rearwardly, second stronger means biasing said abutment forwardly to normally hold said control element in its forward position, and abutment means between said control member and said driven member for forcing said driven member through said power actuated member after said control element has moved into its rearward position and power is not available to actuate said servomotor.

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